



Benefit of Light vs No Light

in vitro study

The Basic Chemistry Behind Hydrogen Peroxide Tooth Whitening

Young N, Fairley P, Mohan V, Jumeaux C. The chemistry behind hydrogen peroxide tooth whitening. J Dent Res 91(Spec Iss B):147, 20012 (www.dentalresearch.org). Philips Research Laboratories, Cambridge, UK

Objective

To examine the basic interactions between whitening agents and stain molecules in simple solutions and to give clarity on the basic chemistry and photochemistry that occurs during the process

Materials

- Black tea stain solution
- Whitening agents of various compositions including hydrogen peroxide, ferrous gluconate, and potassium hydroxide (based on Zoom treatment, Discus Dental, Inc., Culver City, CA, USA)
- Blue light (465nm)
- Infrared light (850nm)

Methodology

The absorbance of tea stain solution at 450nm was measured over a period of 40 minutes, with various compositions of whitening agent added (including hydrogen peroxide, ferrous gluconate and potassium hydroxide in the formulations) and at the same time the samples were subjected to blue light (465nm) or infra-red light (850nm) irradiation, or alternatively were heated.

Results

The reaction rates between chromophores in the tea solution and hydrogen peroxide can be accelerated significantly using ferrous gluconate activator and blue light irradiation. Infrared irradiation was not found to increase the reaction rate through photochemistry but increases the temperature. While raising the temperature can give a slight increase in reaction rate, it can easily lead to inefficiency through the acceleration of exothermic decomposition reactions of hydrogen peroxide.

Conclusion

By carrying out work in simple solution, it was possible to separate the basic chemistry of tooth whitening from the complex physical processes which occur in the tooth during whitening. Ferrous activators and blue light irradiation were shown unambiguously to significantly enhance the whitening process, whereas infrared irradiation or heating has a smaller effect.

Effect of Ferrous Activators and Blue Light Irradiation on Whitening Process

Absorbance at 450nm (Relative)

